DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the solid polyelectrolyte type fuel cell which uses solid polyelectrolyte membrane as an electrolyte layer.
[0002]
[Description of the Prior Art]Drawing 6 is a decomposition sectional view showing the basic constitution of the single cell which is the minimum power generation unit of the conventional solid polyelectrolyte type fuel cell. A membrane electrode complex (MEA;Membrane ElectrodeAssembly) joins the catalyst bed 2 to the both sides of the electrolyte membrane 1, and is formed in them. The carbon paper 5 which plays the role of a gas diffusion layer is arranged on the outside of MEA. Furthermore the separator 10 provided with the gas passageway is allotted to the outside, and while carrying out conduction of the fuel gas and oxidant gas which are supplied to the catalyst bed 2 of MEA via a gas diffusion layer, it is serving to tell outside the current acquired by power generation.
[0003]When using this single cell as a cell and carrying out generating operation, it is constituted as shown in drawing 7. That is, the collecting electrode plate 11 with the role which takes out current to the exterior, and the end plate 12 for bolting are built into the outside of the separator 10 of a single cell, and a single cell is bound tight with the end plate 12 of a lot, the stud 13, and the nut 14, and it is held. The air in which hydrogen contains oxygen to the catalyst bed 2 by the side of an oxidant electrode again is supplied to the catalyst bed 2 by the side of the fuel electrode of MEA, and unreacted gas is taken out as hydrogen exhaust air and air exhaust air outside, respectively. The current which supplied hydrogen and air and was acquired by the produced power generation reaction is taken out outside by the collecting electrode plate 11. By carrying out circulation feed of the cooling water of the cooling water system 15 with the circulating pump 16, generation of heat accompanying a power generation reaction is taken out outside, and temperature control of the single cell is carried out to constant temperature.

[0004]

[Problem(s) to be Solved by the Invention]The separator 10 used for the above-mentioned single cell consists of carbon material, a thick plate is machined, and the gas passageway is formed. For this reason, since there is not only a difficulty that process cost is high, but it forms by machining and the thickness beyond a predetermined value is needed, the thickness of the single cell constituted using this becomes thick, and there is a problem of enlarging.

[0005]Although a metal plate is pressed in wave shape, it is considered as a separator as what is replaced with the above-mentioned composition and the thing using a slot as a gas passageway is known, In this composition, there is a problem that the channel shape which will be obtained if there is a difficulty that the metallic mold for pressing a metal plate is needed and a gas passageway is formed with a press is restricted. The problem of the conventional technology like the above is canceled, the single cell used as a basic constitution unit is formed in a thin shape by low cost, and the purpose of this invention is to provide a compact and cheap solid polyelectrolyte type fuel cell.

[0006]

[Means for Solving the Problem]In a solid polyelectrolyte type fuel cell of this invention in order to attain the above-mentioned purpose, (1) Between a gas diffusion layer which consists of carbon paper or carbon crossing allotted to both outside surfaces of a membrane electrode complex, and a plate-like separator, For example, gas-passageway members forming which consists of carbon paper or an expanded graphite sheet cut out by punching is allocated, and suppose that a gas passageway for reactant gas conduction is formed in space of a portion where carbon paper lacked by decision between a gas diffusion layer and a separator.

[0007](2) Suppose that gas-passageway members forming of the above (1) is bound to a gas diffusion layer using a conductive material, for example, a conductive material which consists of a mixture of a fluoro-resin and a carbon particle.

(3) Or suppose that gas-passageway members forming is bound to a gas diffusion layer like the above (2) after forming a catalyst bed in a gas diffusion layer with a replica method or screen printing and binding an electrolyte membrane on the catalyst bed further beforehand again.

[0008](4) The above (1) Suppose that sheet metal of stainless steel and titanium which performed noble metal plating for a separator to the surface, or a titanium alloy, or a coat of carbon is formed from sheet metal of stainless steel and titanium which were formed in the surface, or a titanium alloy in - (3).

If a gas passageway is formed as shown in above (1), a gas-passageway pattern becomes settled with a pattern of decision, and since there is no restriction in decision, arbitrary patterns can be selected. Since height of a gas passageway is decided by thickness of carbon paper to cut out, it is easy to consider it as a film extremely. Since it becomes unnecessary to provide a separator in particular with a gas passageway like a conventional example, it becomes easy for what is necessary to be just to use a very thin metal plate therefore, and to form a single cell very thinly.

[0009]As shown in above (2) or (3) then, it excels in conductivity and a compact cell can be constituted. If material of a separator is selected as shown in above (4), the stable characteristic is obtained and it is very effective for slimming down of a cell.

[0010]

[Embodiment of the Invention]<Example 1> drawing 1 is an exploded perspective view showing the construction of the single cell of the 1st example of the solid polyelectrolyte type fuel cell of this invention, and is an electrode area. The single cell of 50-cm^2 is shown. The fabrication sequence is as follows.

[0011]In first, a center section Thickness provided with the hole of the rectangle of 71mm x 71mm With the 0.8-mm frame shape resin sheet 7, the periphery of the electrolyte membrane 1 was covered, it bowed down, and the electrolyte membrane was formed. Subsequently, it is each to both sides of the portion of this electrolyte membrane 1 that bows down and does not have a resin sheet of an electrolyte membrane. The catalyst 2 of the platinum base of the rectangle of 71mm x 71mm was transferred with the replica method, and the membrane electrode complex (MEA) was formed. Next, the carbon paper 5 is arranged as a gas diffusion layer on the catalyst bed of both sides of MEA manufactured in this way, Thickness which has arranged the carbon paper 4 moreover cut out by the pectinate form like the graphic display as gas-passageway members forming, and gold-plated on it further The separator 8 which consists of 0.2-mm stainless steel (SUS316) has been arranged, and the single cell was constituted. The thickness of the manufactured single cell is abbreviation. It is 2 mm and was able to have very thin composition.

[0012]Drawing 5 is a characteristic figure showing the voltage obtained by doing the power generation examination of the single cell which was carried out in this way and manufactured - a current characteristic as compared with the characteristic of the single cell of the conventional composition like drawing 6. As seen in a figure, in spite of being formed in the very thin cell, almost equivalent voltage - a current characteristic are acquired.

<Example 2> drawing 2 is an exploded perspective view showing the construction of the single cell of the 2nd example of the solid polyelectrolyte type fuel cell of this invention, and this example is also an electrode area. The single cell of 50-cm^2 is shown. The fabrication sequence in this example is as follows.

[0013]First, on the carbon paper 5 which serves as a gas diffusion layer as shown in drawing 2 (a), The paste 6 which mixed the particles of carbon and the particles of PTFE (polytetrafluoroethylene) at a rate of 1:1 is applied, The carbon paper 4 cut out to the pectinate form on it is arranged. The pressure of 1MPa was applied and pressed in 350 **, and the carbon paper 5 and the carbon paper 4 cut out to the pectinate form were unified.

[0014]Then, on the catalyst bed 3 of both sides of MEA manufactured by the same method as Example 1 as shown in drawing 2 (b), Thickness which made the carbon paper 5 counter the catalyst bed 3, has arranged the above-mentioned unified carbon paper 5 and the carbon paper 4, and gold-plated on it further The separator 8 which consists of 0.2-mm stainless steel (SUS316)

has been arranged, and the single cell was constituted. The thickness of the manufactured single cell is about 2 mm like Example 1, and became very thin composition.

[0015]having written together the characteristic of the generating operation of the single cell manufactured by this method to drawing 5 -- it is -- compared with the characteristic of the single cell of structure, and the single cell of Example 1, the significant difference was not accepted conventionally. That is, it turned out that a predetermined power generation characteristic is acquired with the very thin composition also as this composition.

[0016]<Example 3> drawing 3 is an exploded perspective view showing the construction of the single cell of the 3rd example of the solid polyelectrolyte type fuel cell of this invention. Electrode area of this example The fabrication sequence of the single cell of 50-cm^2 is as follows. First, as shown in drawing 3 (a), on the carbon paper 5 used as a gas diffusion layer, the catalyst 2 of the platinum base was used and the catalyst bed 3 was formed with screen printing. Subsequently, the carbon paper 4 which judged the particles of carbon and the particles of PTFE like Example 2 at the pectinate form using the paste 6 mixed at a rate of 1:1 to the field at which the catalyst bed 3 of this carbon paper 5 has not arrived was made to unify.

[0017]Then, as shown in drawing 3 (b), the thing of use and the appearance bow [Example / 1] down, and the electrolyte membrane 1 of an electrolyte membrane, It inserted with two integrated objects formed like the above so that the catalyst bed 3 side might counter the electrolyte membrane 1, and the pressure of 1MPa was applied and pressed in 350 **, and the electrolyte membrane 1, the catalyst bed 3, the carbon paper 5, and the carbon paper 4 cut out to the pectinate form were made to unify. Thickness which performed the same gold plate as Examples 1 and 2 to both sides of this integrated object The separator 8 which consists of 0.2-mm stainless steel (SUS316) has been arranged, and the single cell was constituted. The thickness of the manufactured single cell is abbreviation like Examples 1 and 2. It was 2 mm.

[0018]As written together to drawing 5, the power generation characteristic whose single cell manufactured by this method is also almost equivalent to Examples 1 and 2 was acquired.

<Example 4> drawing 4 is an exploded perspective view showing the construction of the single cell of the 4th example of the solid polyelectrolyte type fuel cell of this invention.

[0019]The difference of the single cell of this example and the single cell of Example 3 is in the carbon material which constitutes a gas diffusion layer. That is, although the gas diffusion layer was formed using the carbon paper 5 in Example 3, in this example, the carbon paper 5 is replaced and the carbon crossing 9 is used. The method of formation of the catalyst bed 3 by the screen printing using the catalyst 2 of a platinum base, the unification with the carbon paper 4 cut out to the pectinate form using the paste 6, and the unification with the electrolyte membrane 1 is the same as that of Example 3.

[0020]the single cell manufactured by this method -- thickness -- about -- As it was 2 mm and having been written together to drawing 5, the power generation characteristic almost equivalent to Examples 1, 2, and 3 was acquired. Thickness to which it gold-plated in the above-mentioned

Examples 1-4 at the separator 8 in any case Although 0.2-mm stainless steel is used, In view of the characteristic, the material of the separator 8 is not limited to this, may be replaced with stainless steel, and may use the sheet metal of titanium or a titanium alloy. Gold plate can be replaced, plating of other precious metals may be used, and the ultra-thin single cell which had the predetermined performance also as replacing plating and forming the coat of carbon in the surface further can be formed.

[0021]In the above-mentioned Examples 2-4, although the mixture of the particles of carbon and the particles of PTFE is used as the conductive paste 6, it changes to the particles of PTFE and is good also as a conductive paste using the particles of FEP.

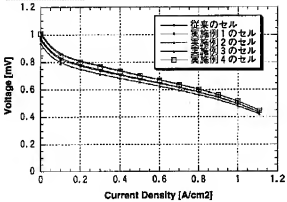
[0022]

[Effect of the Invention]As mentioned above, in the solid polyelectrolyte type fuel cell of this invention, Between the gas diffusion layer which consists of the carbon paper or the carbon crossing allotted to both the outside surfaces of the membrane electrode complex, and the separator which consists of metal thin plates, For example, the gas-passageway members forming which consists of carbon paper cut out by punching is allocated, Since the gas passageway for reactant gas conduction is formed in the space of a portion where carbon paper lacked by decision between a gas diffusion layer and a separator, The single cell used as a basic constitution unit will be formed in a thin shape by low cost, and a compact and cheap solid polyelectrolyte type fuel cell will be obtained.

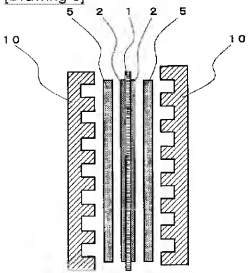
[Translation done.]

DRAWINGS

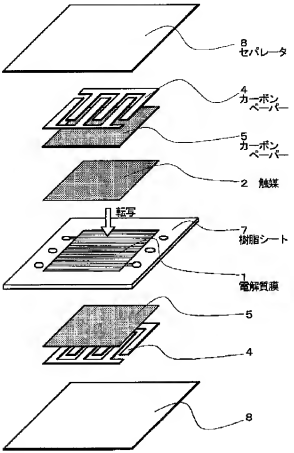
[Drawing 5]



[Drawing 6]

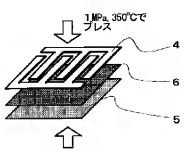


[Drawing 1]

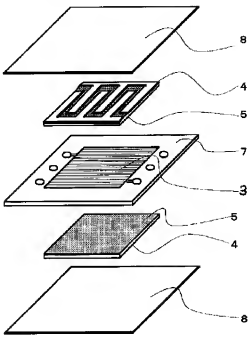


[Drawing 2]

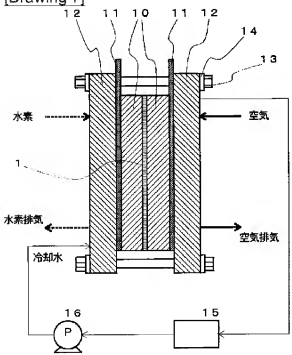
(a)


1MPa, 350℃で
プレス
4
6
5

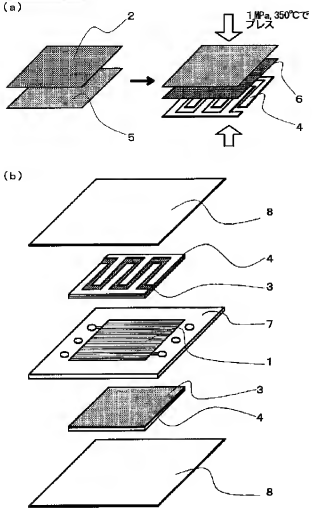
(b)


8
4
5
7
3
5
4
8

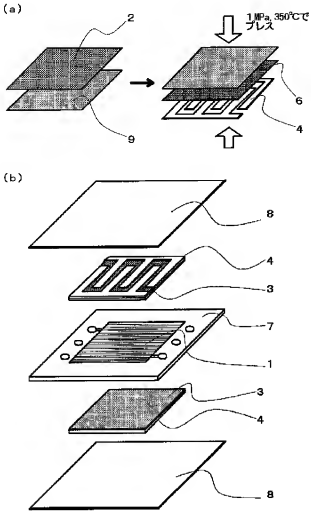
[Drawing 7]


12
11
10
11
12
14
13
水素
空気
1
水素排気
空気排気
冷却水
16
15
P

[Drawing 3]



[Drawing 4]



[Translation done.]